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SOIL MOISTURE MONITORING BASED ON LONG-TERM TIME SERIES LAND SURFACE TEMPERATURE (LST) DATA - A CASE STUDY IN HEBI CITY, HENAN PROVINCE

JINQIU ZOU, JIANMENG GAO, JINTANG WEI[1] AND CHUNKUN FAN[1,2]*

Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, Beijing, China

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Abstract

Long time-series land surface temperature (LST) data acquired by moderate-resolution imaging spectroradiometer (MODIS) were used to calculate temperature vegetation dryness index ($TVDI_{time}$) data. Results showed that predicted soil water contents fit well with the data measured by 12 meteorological sites and 25 manually measured data, with identical variation tendency. It indicates that the soil moisture prediction method presented in this paper is highly effective. This method will help to provide scientific and technical supports for making intelligent decisions, guiding measures of the agricultural irrigation and enhancing grain yield.

Introduction

Drought is one of the most serious natural disasters in agricultural production, and it is also a kind of natural phenomenon in specific areas with insufficient water in the near-surface ecosystem (Wang *et al.* 2010). Long-period drought changes may have formed different types of arid zones around the world. According to the estimations by the Food and Agriculture Organization of the United Nations (UNFAO), drought-induced loss in global agriculture can be as high as billions of dollars per year, and more than 56 billion yuan is lost each year in China. Traditional drought monitoring mainly relies on the measurement of soil water content in the drought monitoring stations for representing small-scale soil moisture (Wang *et al.* 2008). Remote sensing (RS) monitoring exhibits a series of advantages such as fast monitoring velocity, large-area coverage, and low cost. Therefore, it is of significant economic value and practical significance to monitor agricultural drought and soil moisture based on RS monitoring data.

A number of studies have been conducted and proposed multiple agricultural drought RS monitoring indices from different angles (Sun *et al.* 2012, Yang *et al.* 2010). However, due to the difference in climate, soil and crop planting among various areas, the monitoring indices exhibit apparent difference in space-time adaptability, thereby resulting in the lack of uniform and eurytopic models and methods. The reasons lie in the following two aspects. Firstly, the distribution and development of agricultural droughts differ greatly in both space and time. Secondly, crops reflect different agricultural drought characteristics in different regions at different growth phases (Mu *et al.* 2006, Li *et al.* 2013, Wang *et al.* 2013, Ezzine *et al.* 2014, Dong *et al.* 2015, Huang *et al.* 2015). By contrast, temperature vegetation dryness index (TVDI) now witnesses extensively applications since it takes vegetation index and surface temperature into overall consideration (Sandholt *et al.* 2002). TVDI should be solved on the basis of assumption that smaller soil moisture content corresponds to higher land surface temperature (LST) under a

*Author for correspondence: <fanchunkun@taaas.org>. [1]Seed Management Station of Dingxi city in Gansu Province, Dingxi, 743000, Gansu, China. [2]Agricultural Research Institute, Tibet Academy of Agricultural and Animal Husbandry Sciences, Tibet Lhasa 850032, Xizhuang, China.